



空中乘务专业教材

AIRCRAFT CABIN SYSTEMS AND EQUIPMENT

飞机客舱系统与设备

刘小娟◎主编 李玉梅◎主审

中国民航出版社

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图书在版编目 (CIP) 数据

飞机客舱系统与设备: 英汉对照/刘小娟主编. —
北京: 中国民航出版社, 2011. 4
ISBN 978-7-5128-0017-5

I. ①飞… II. ①刘… III. ①飞机-客舱-教材-英
汉 IV. ①223

中国版本图书馆 CIP 数据核字 (2011) 第 044028 号

责任编辑: 李婷婷

飞机客舱系统与设备

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出版 中国民航出版社
地址 北京市朝阳区光熙门北里甲 31 号楼 (100028)
排版 中国民航出版社照排室
印刷 北京金吉士印刷有限责任公司
发行 中国民航出版社 (010) 64297307 64290477
开本 787 × 1092 1/16
印张 10.5
字数 236 千字
版本 2011 年 4 月第 1 版 2011 年 4 月第 1 次印刷

书号 ISBN 978-7-5128-0017-5
定价 26.00 元

(如有印装错误, 本社负责调换)

前言

近年来,随着我国经济和国内航空运输市场的迅猛发展,到中国进行商务活动和旅游的外籍乘客越来越多,机上外籍乘务员的数量也在逐渐增加。同时,目前国内航空公司所运行的绝大部分飞机属于波音和空客两大飞机制造商生产,其客舱设备大多使用英文标识,从而需要乘务员具备更高的专业英语水平。因此,航空公司如何有效提升乘务员的专业素质便成了当务之急。

在全国众多开设空中乘务专业的院校中,相关英语教材还是空白。因此,本教材的编写和出版致力于填补客舱安全服务领域与国际接轨的空白。考虑到乘务专业教学特点,本教材内容与空中乘务员岗位要求紧密结合,主要包括国内航空公司单通道主流机型即波音新一代 737 系列和空客 320 系列。由于各航空公司在机型订购时要求不统一,客舱里的内部设施、应急设备的数量和位置也会有所不同,编者在收集了大量的乘务员机型操作手册的基础上突出共性,避免差异性。学生通过本教材的学习既能掌握这两种机型的性能、客舱布局、客舱主要系统和设施,使他们在航空公司培训和工作中能很快适应岗位要求,同时还能在专业英语方面得到有效的训练。在实际工作中,学生若要有效吸收和借鉴国外航空公司有关客舱安全和客舱管理的最新信息,其自身需要具备良好的专业知识和较强的专业英语水平,只有这样,他们才能在地不断地实践中开辟广阔的职业发展空间。

为了使学生对《飞机客舱系统与设备》知识更直观地了解和掌握,教材中配有大量插图,并且每课还附有四个练习题供学生课后复习,这些练习题是对各课重点和难点的归纳。

本教材在编写过程中得到了国内各大航空公司客舱部以及中国民航大学乘务学院“飞机客舱系统与设备”课程组林虹、赵玉秋、王爱国、刘雪莹、孙重凯等老师的大力支持和帮助,本教材由李玉梅教授审阅,在此一并表示衷心的感谢。

由于编写时间有限,教材中难免出现一些错误和疏漏,望读者和专家不吝赐教。

编者

2011 年 1 月

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Part One Boeing 737-700

Preface History of Boeing Commercial Aircraft

In 1903, two events launched the history of modern aviation. On December 18th, 1903, the Wright brothers made the first powered flight at Kitty Hawk, North Carolina, and William Boeing, born on Oct. 1, 1881, in Detroit, Michigan, left Yale Engineering College for the West Coast of the United States.

In 1910 William Boeing bought Heath's shipyard on the Duwamish River, just outside Seattle. Heath's shipyard became Boeing's first airplane factory. In the early years of airplane manufacture, Boeing established a high reputation for sea planes. These aircraft were mainly used for carrying mail across the United States and Canada. Boeing developed many other types of aircraft both for the military as well as for the fledgling (年轻而无经验的) passenger air service business. The peak of sea plane development was the introduction of the Boeing 314A, called the Clipper. It was the largest passenger flying boat ever to be introduced into passenger service and for the first time opened up a sensible air service across the Pacific and North Atlantic, combining safety, comfort and performance.

In 1939, Clipper services were introduced from San Francisco across the Pacific to Hong Kong and then to Shanghai.

At the end of World War II, Boeing made use of their technology in producing high volumes of large bombers, the Super Fortress, as their newly found experience of Jet engines and designed and developed a four-jet-engine fuel tanker called the KC135A. It first flew and went into service with the US air force in 1954. Following on from this design, came the first high volume jet airliner, Boeing 707. It first flew in 1963 and went into service with Pan-Am in 1965. This aircraft established standards of comfort, service and speed. There were 1 010 manufactured until production came to an end in 1991.

Following very closely after the service introduction of the 707 came the 727. This airplane was designed for short to medium frequent operations. It had three engines installed in the tail of the airplane. It first flew in 1963 and entered service in 1965. Until production stopped in 1984, there were 1 831 airplanes manufactured.

In 1967, it was time for the two-engine Boeing 737-200 to make its appearance on the world stage. It was designed for short haul frequent airline operations and in order to save production time, it used the same fuselage sections as the 707 and 727. The aircraft has been continually developed, in both passenger size and engine size. In 1998, the Next-Generation of B737 families (737-600/-700/-800) came in service, and the latest model, Boeing 737-900, entered service in 2001. From 2002 to 2010, Boeing Company has received more than 3 400 orders from different airlines. By May 2010, more than 8 000 Boeing 737 of all series have been in service all over the world.

The first flight of 747 was in 1969. It went into service with Pan-Am on the New York — London routes. It was an immediate success with both airlines and passengers. Every airline had to have 747's in their fleet. In the first ten years of operation, more than 500 airplanes were delivered at a rate of one every week. Over the last 35 years it has grown in passenger size and range and in 2004 it was still the largest aircraft in the world. It remained so until the first flight of the Airbus 380 in 2005. As with all the airplanes in the Boeing family, the airplane has been constantly developed in size, range and economy. Boeing has built 15 different 747 models over the years, and has delivered more than 1 380 747's. The largest and most cost-effective (划算的) version, the first 747-400 was delivered in 1989 and was still in production in passenger and freight versions in 2004. Officially announced in 2005, the 747-8 is the fourth-generation Boeing 747 version, with lengthened fuselage, redesigned wings and improved efficiency. The 747-8 is the largest 747 version and the largest commercial aircraft built in the United States, as well as the longest passenger aircraft in the world. The 747-8 first flew on February 8, 2010. Delivery of the first 747-8 freighter has been postponed multiple times and is now expected in mid-

2011.

In 1981, the first member of the Boeing 767 family made its first flight. The 767 has become a complete family of airplanes in the 200 ~ 300 seat market. The family includes three passenger models: the 767-200ER in service in 1984, 767-300ER in service in 1988, and 767-400ER in service in 2000. It is a twin aisled, wide bodied airplane with two engines.

In 1982, the Boeing 757-200, a short-to-medium range airliner, made its first flight. It combined advanced technology for exceptional fuel efficiency, low noise levels, increased passenger comfort and excellent operating performance. The 757-200 and twin-aisle 767 were developed at the same time, so that both share the same technological advancements in propulsion (推力), aerodynamics (空气动力学), avionics and materials. This commonality (共性) reduces training and spares (备件) requirements when both airplanes are operated in the same fleet. When the production line for the 757 closed in 2004, more than 1 000 airplanes had been built.

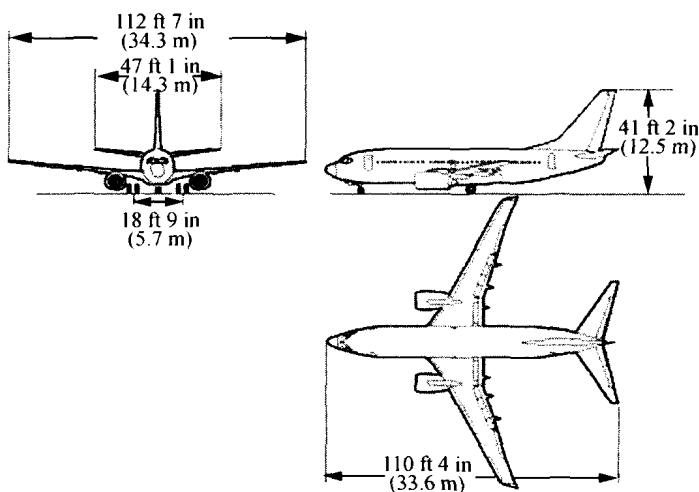
In 1995, the first of a new family of airplanes entered services with United Airlines. This was the Boeing 777-200, a wide bodied, twin aisled, twin-engined large long haul airplane. It was larger in size than the largest of the Boeing 767, but smaller than the 747-400. It brings to the airline the economics advantages of a twin-engined airplane with medium-to-long range passenger markets. The airplane was designed and developed in association with airline customers. It was designed to meet the increasing expectations of customers in the 21st century. From the technological aspect, it was the first airplane to be designed 100% by computer. The Boeing 777 is the flagship (旗舰) of airlines worldwide with its industry-leading reliability, unmatched (无比的) twin-engine performance and spacious (宽敞的) cabin. The 777 offers ample (宽敞的) cabin space and various interior configurations make it the preferred plane for passengers in every class. Three-class seating in the passenger versions ranges from 301 to 368.

The Boeing 787 Dreamliner is the family of new, super-efficient airplanes that brings big-jet comfort and economics to the midsize market. The 787 incorporates advanced composite (合成的) materials, systems and engines to provide unprecedented (空前的) performance levels, including a 20% improvement in fuel efficiency over existing small twin-aisle airplanes. The 787-8 and larger 787-9 will serve the 200- to 300-seat market on flights as long as 8 500 nautical miles (海里) (15 750 km) in three-class seating. A third family member, the 787-3, will hold up to 330 passengers in two-class seating and will be optimized (最优化) for routes of 3 050 nautical miles (5 650 km). The first 787 made its first flight in December 2009. The first delivery was scheduled for the fourth quarter of 2010.

Lesson 1 Airplane Description

General Information

The 737-700 is a short-to-medium range airplane. It is based on a key Boeing philosophy of delivering added value to airlines with reliability, simplicity and reduced operating and maintenance costs. The length from the nose to the tail is 33.60 meters; the width between the two wings (wingspan) is 34.30 meters; the interior cabin width is 3.53 meters. On the ground the height from the top of the tail plane to the ground is 12.50 meters, and the distance between the doorsill of the forward cabin doors to the ground is 2.67 meters and the



Principal Dimensions

aft is 2.92 meters. It is powered by two new CFM56-7 engines which offer lower fuel burn and lower engine maintenance costs. They are mounted under and forward of the wings. Each engine develops nearly 24 000 pounds of thrust, depending on the specific aircraft type, which is more than enough to allow a safe takeoff with the loss of one of the engines. Its maximum takeoff weight is over 60 000 or 70 000 kilograms, depending on the specific aircraft type. The maximum range is over 5 000 kilometers, and its typical cruise speed at 35 000 feet is nearly 340 knots or 629 kilometers (0.82 mach) per hour. The maximum operating altitude is 41 000 feet or 12 500 meters.

The airplane consists of three parts: the nose, the fuselage and the tail.

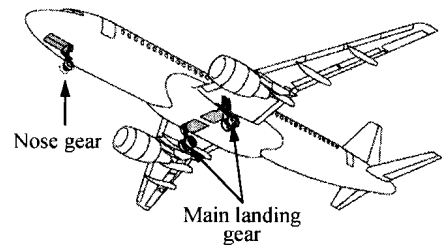
In the nose of the aircraft is the cockpit. It is the flight control center. The B737 flight deck features state-of-the-art display and digital electronic systems that allow the two crew members to function as system managers. It can hold two pilots and one observer with the pilot-in-command sitting on the left-hand position. A stowage observer's seat is installed

forward of the flight deck door. Directly in front of the pilot is the control column. On both sides of the pilot jumpseats are the two sliding windows, where pilots can evacuate from the cockpit in the event of emergency. The window lock lever controls their movements.

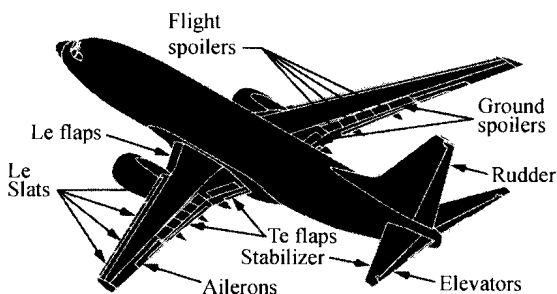
The fuselage has a circular cross section and is entirely pressurized with the exception of the nose and tail cones, the landing gear bays and air conditioning compartments. It is divided into two parts: the upper deck, which is the cabin area, and the lower deck, which is the cargo compartment. The passenger cabin is split into three zones: the forward (FWD), the mid and the aft. Normally the 737-700 is capable of carrying 126 passengers for typical two-class configuration or 149 passengers for typical one-class configuration. The designed passenger seating capacity may vary due to the different requirements by the airlines. There are four passenger seats each row in the Business Class and six seats in the Economy Class. All the seats are equipped with food trays and seat belts. They can be reclined by pressing the recline-button on the armrest, but the seats close to and forward of the overwing emergency exits do not recline.

Under the passenger cabin are the two cargo compartments. They are sealed and pressurized but do not have fresh air circulation and temperature control as the upper passenger cabin does. The usable cargo compartment volume is 1 068 cubic feet.

The landing gears are of retractable, tri-cycle type. The nose landing gears retract forward into the fuselage. The main landing gears are mounted under the wings and retract towards the center. The wings are positioned on both sides of the fuselage. They consist of slats, flaps, spoilers and ailerons. Each provides auxiliary control. There is one engine under each wing and they provide power to the airplane.



Landing Gears



Flight Control Surfaces

The tail cone consists of rudder, elevator, stabilizer and the Auxiliary Power Unit (APU). The APU is mounted in the tail of the airplane and it is a gas turbine engine that can work both in the air and on the ground. The APU can supply electrical power to operate the airplane systems on the ground if the external ground services are not available. It can also provide bleed

air for air conditioning and pressurization. In flight, the APU is capable of serving as a back-up for the engine bleed air system up to 17 000 feet.

The primary electrical power system supplies 115 volt, 400 cycle Alternating Current (AC) and 28 volt Direct Current (DC) electrical power to the airplane. If the electrical system loses one or more generators, electrical power on the galleys is removed automatically.

Normally, the air for air conditioning is supplied by the engines. Cabin temperature is controlled automatically to maintain between 18°C (65 °F) and 29°C (85 °F) selected by the pilots. Temperature can also be controlled manually to suit the needs of passengers and cabin crew. It is controlled separately for the passenger cabin and the flight deck.

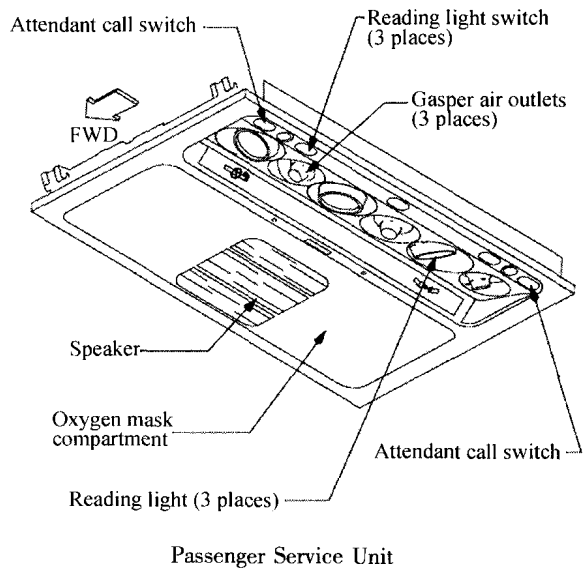
Passenger Cabin Interior

There are six exits for B737-700, four cabin doors and two overwing emergency exits. Normally, the two entry doors, located forward and aft on the left side of the airplane, are mainly for passengers boarding and disembarking. They are Door L1 and Door L2 respectively. Service doors are located on the right side of the airplane, forward and aft. They are Door R1 and Door R2 respectively. These two cabin doors are normally used for servicing by the ground crews. The four cabin doors can be opened or closed manually from inside or outside the aircraft. They can be used as exits in an emergency. The overwing emergency exits are smaller than the four cabin doors and are used for emergency only.

Generally there are five flight attendant jumpseats inside the cabin, which are located close to the cabin doors and face backward. They are pull-down types that automatically return to the stowed position when unoccupied. A combination of a seat belt, shoulder harness and a padded headrest are installed in the seat. When the airplane is moving on the ground, taking off and landing, cabin crew must secure themselves properly in their seats to avoid personal injury. Communication handsets, attendant panels and microphones are installed at the attendant stations. Emergency equipment, a work light and an attendant service unit containing oxygen masks for each attendant are installed near each attendant station.

Overhead stowage bins run the length of the cabin and stow blankets, pillows and carry-on items. Each overhead bin is 80 inches (203 centimeters) long, and its maximum weight is 160 pounds (72.5 kg), which is clearly marked on a placard. Emergency equipment such as portable oxygen cylinders, fire extinguishers and megaphones may also be stored in the bins. A new handrail on the overhead stowage bins is offered for added passenger and flight attendant convenience. The handrail provides both cabin crew and passengers support when they are loading carry-on items or moving about in the cabin.

The Passenger Service Units (PSU) are installed in the bottom of the overhead bins. Each unit has a reading light and its switch, supplemental passenger air, emergency oxygen equipment, a NO SMOKING /FASTEN SEAT BELT sign and an attendant call switch. Every other PSU has a speaker installed. There are special arrangements when there are disabled passengers on board. They must be seated in the same section, either in the forward or in the aft, but they can't sit in the mid part of the cabin because there are no floor level exits around.



There are two galleys in the passenger cabin so as to provide convenient and rapid service to passengers. They are generally installed in the cabin next to the forward and aft galley service doors. In general the equipment of the galley unit consists of the following main items: ovens, hot cups, water boilers, waste containers and main storage compartments. The galleys are equipped with electrical power and water services.

There are three lavatories on board, one in the forward and two in the aft. Each lavatory contains a toilet, wash basin, mirror and all the necessary vanity items and disposal units. For the convenience and comfort of passengers with some special needs, some of the lavatories are equipped with diaper changing tables and handicap provisions. Ventilation is provided and air exhausts through overboard vents.

New Words

jetliner ['dʒetˌlaɪnə]	n. 喷气客机
doorsill ['dɔːsɪl]	n. 门槛
fuel [fjuəl]	n. 燃油
maintenance ['meɪntɪnəns]	n. 维护, 保持
mount [maʊnt]	vt. 安放, 设置
thrust [θrʌst]	n. 推力
maximum ['mæksɪmə]	n. 最大量, 最大限度, 极大

altitude ['æltitju:d]

nose [nəuz]

fuselage ['fju:zilɑ:ʒ]

cockpit ['kɒkpit]

feature ['fi:tʃə]

state-of-the-art

digital ['didʒɪtl]

stowage ['stəʊɪdʒ]

install [in'stɔ:l]

column ['kɒləm]

lever ['li:və, 'levə]

circular ['sə:kjulə]

bay [bei]

configuration [ken,figju'reiʃən]

tray [trei]

recline [ri'klein]

seal [si:l]

retractable [ri'træktəbl]

circulation [,sə:kju'leifən]

tri-cycle ['traisɪkl]

retract [ri'trækt]

slat [slæt]

flap [flæp]

spoiler [spɔɪlə]

aileron ['eɪlərən]

auxiliary [ɔ:g'ziljəri]

rudder ['rʌdə]

elevator ['eliveɪtə]

stabilizer ['steɪbalaɪzə]

external [eks'tɜ:nl]

back-up (= back up)

generator ['dʒenəreɪtə]

manually ['mænjuəli]

unoccupied ['ʌn'ɒkjupaɪd]

adj. 最高的, 最多的, 最大极限的

n. (尤指海拔) 高度

n. [空] 机头

n. [空] 机身

n. 驾驶舱

vt. 是…的特色

adj. (学科, 技术等的) 当前水平, 最新水平

adj. 数字的

n. 存储

vt. 安装, 安置

n. 柱, 柱形物

n. 手柄

adj. 圆形的

n. 分隔舱

n. 布局, 构造, 结构

n. 盘, 碟, 盘子

v. 放置

vt. 封, 密封

adj. 可收回的

n. 循环, 流通

n. 三轮

v. 缩回, 收回, 取消, 撤销

n. 缝翼

n. 襟翼

n. 扰流板

n. 副翼

adj. 辅助的, 补助的

n. 方向舵

n. 升降舵

n. 水平尾翼

adj. 外部的, 客观的

v. /n. 备份

n. 发电机, 发生器

adv. 手工地, 手动地

adj. 空闲的, 无人占领的

padded [ˈpædɪd]
 secure [siˈkjʊə]
 panel [ˈpænl]
 handset [ˈhændset]
 microphone [ˈmaɪkrəfəʊn]
 placard [ˈplækɑːd]

megaphone [ˈmegəfəʊn]
 handrail [ˈhændreɪl]
 switch [swɪtʃ]

oven [ˈʌvən]
 toilet [ˈtɔɪlɪt]
 vanity [ˈvænɪti]
 disposal [dɪsˈpəʊzəl]
 diaper [ˈdaɪəpə]
 handicap [ˈhændɪkæp]
 provision [prəˈvɪʒən]
 ventilation [ˌventɪˈleɪʃən]
 exhaust [ɪɡˈzɔːst]
 vent [vent]

adj. 加垫子的
v. 保护; 扣紧
n. 面板
n. 电话听筒, 手机, 手持机
n. 扩音器, 麦克风
n. 布告, 标牌
v. 张贴
n. 扩音器, 喇叭
n. 栏杆, 扶手
n. 开关, 电闸, 转换
vt. 转换, 转变
n. 烤箱, 烤炉
n. 厕所, 洗手间; 抽水马桶
n. 浴室里的壁橱
n. 处理, 处置
n. 尿布
v. 妨碍; 加障碍于; 使受障碍
n. 供应, (一批) 供应品
n. 通风, 流通空气
vi. 排气
n. 通风孔, 出烟孔, 出口

Technical Terms

doorsill height
 maximum takeoff weight
 maximum range
 cruise speed
 maximum operating altitude
 pilot-in-command
 flight deck
 control column
 sliding window
 tail cone
 landing gear

门槛高度
 最大起飞重量
 最大航程
 巡航速度
 最大飞行高度
 责任机长
 驾驶舱
 操纵杆
 (驾驶舱里的) 滑动窗
 尾翼
 起落架

air conditioning compartment	空调舱
cargo compartment	货舱
Business Class	公务舱，商务舱
Economy Class	经济舱
seat belt	安全带
overwing emergency exit	翼上紧急出口
cubic foot	立方英尺
Auxiliary Power Unit (APU)	辅助动力装置
emergency equipment	应急设备
attendant service unit	乘务员服务组件
bleed air	(发动机) 引气
Alternating Current (AC)	交流电
Direct Current (DC)	直流电
shoulder harness	肩带
oxygen mask	氧气面罩
overhead stowage bin	头顶行李箱
carry-on	手提行李
portable oxygen cylinder	便携式氧气瓶；手持式氧气瓶
fire extinguisher	灭火瓶
Passenger Service Unit (PSU)	旅客服务组件
floor level exit	地板高度出口
hot cup	烧水杯
water boiler	烧水器

Notes

1. The 737-700 is a short-to-medium range airplane. It is based on a key Boeing philosophy of delivering added value to airlines with reliability, simplicity and reduced operating and maintenance costs. 波音 737-700 是中短程飞机。它根植于波音的核心理念：可靠、简捷，且极具运营和维护成本，为航空公司客户创造更多价值。
2. It is powered by two new CFM56-7 engines which offer lower fuel burn and lower engine maintenance costs. They are mounted under and forward of the wings. Each engine develops nearly 24 000 pounds of thrust, depending on the specific aircraft type, which is more than enough to allow a safe takeoff with the loss of one of the engines. 两台 CFM56-7 发动机为其提供动力，这种新型发动机能降低燃油消耗和维修成本。发

动机安装在机翼下前侧。根据具体机型，每台发动机产生的推力大约为 24 000 磅，即使一台发动机失效，另一台发动机产生的推力也足够使飞机安全起飞。

注：CFM 国际公司由法国 SNECMA 公司、美国 GE 公司组成。CFM56-7 发动机的优点：噪声和污染显著降低，维护成本降低约 15%，发动机可靠性保持不变。CFM56-7 发动机主要安装在波音 737-600/-700/-800 等机型。

3. The maximum range is over 5 000 kilometers, and its typical cruise speed at 35 000 feet is nearly 340 knots or 629 kilometers (0.82 mach) per hour. 飞机的最大航程超过 5 000 公里，在 35 000 英尺高度时其典型巡航速度大约为每小时 629 公里（0.82 马赫数）。

注 1：飞机的马赫数是指飞机的飞行速度与当地大气（即一定的高度、温度和大气密度）中的音速之比。课文中的 0.82mach 表示飞机的速度为当地音速的 0.82 倍。

注 2：巡航速度是一种最经济的飞行速度，在飞行同等距离时它的耗油量最小。

4. On both sides of the pilot jumpseats are the two sliding windows, where pilots can evacuate from the cockpit in the event of emergency. 飞行员座椅两侧是两个滑动窗，紧急情况下飞行员可通过滑动窗从驾驶舱撤离。

注：关系副词 where 引导的非限定性定语从句修饰 sliding windows。

5. The fuselage has a circular cross section and is entirely pressurized with the exception of the nose and tail cones, the landing gear bays and air conditioning compartments. 机身呈弧形截面，除机头、尾翼、起落架舱和空调舱外，整个机身都要加压。
6. Normally the 737-700 is capable of carrying 126 passengers for typical two-class configuration or 149 passengers for typical one-class configuration. The designed passenger seating capacity may vary due to the different requirements by the airlines. 波音 737-700 型飞机典型的两舱布局时可装载 126 名旅客，典型的单舱布局时可装载 149 名旅客。旅客座位数会根据航空公司的不同需求进行调整。

注：两舱布局是指头等舱或公务舱加经济舱布局；单舱布局是指客舱全为经济舱，无头等舱或公务舱。

7. In flight, the APU is capable of serving as a back-up for the engine bleed air system up to 17 000 feet. 飞机在 17 000 英尺高度时，辅助动力装置可以为发动机引气系统提供备份。
8. Each unit has a reading light and its switch, supplemental passenger air, emergency oxygen equipment, a NO SMOKING /FASTEN SEAT BELT sign and an attendant call switch. Every other PSU has a speaker installed. 每个旅客服务组件包括阅读灯、通风孔、应急氧气设备、禁止吸烟 / 系好安全带信号牌灯和乘务员呼叫电门。每两个旅客服务组件装有一个扬声器。

注: every other 和 every second 用法区别。every second 是“每逢第二个”, every other 是“每隔一个”或“每两个”。

例: He goes to practise violin every second week of the month.

他每个月的第二个星期去学习小提琴。

He goes to practise violin every other week of the month.

他每个月会隔一个星期去学习小提琴。

9. Each lavatory contains a toilet, wash basin, mirror and all the necessary vanity items and disposal units. 每个厕所里都有马桶、洗手池、镜子和所有必需的卫生用品以及垃圾箱。

Exercises

I. Please answer the following questions.

1. What kind of aircraft is the B737-700?
2. Which part of the aircraft controls the cabin temperature? What's the temperature range?
3. How many passengers and cabin crew can B737-700 hold onboard?
4. What are the cabin crew required to do during takeoff?
5. What items can be found near the flight attendant station?
6. Which section of the cabin is not appropriate for the handicapped passengers to sit in?
7. Where are the galleys?
8. What items can be found in the lavatories?
9. What are the main characteristics of the cargo compartment?
10. What's the function of the APU?

II. Please fill in the blanks with the words given. Change the form where necessary.

install	altitude	disposal	configuration	provision	maintenance
handicap	recline	ventilation	exhaust	supplemental	feature

1. You need to add some _____ information to get the visa.
2. The local government is responsible for the _____ of support for the poor.
3. The bad weather severely _____ the airline's flight schedule.
4. All the passengers feel hard to breathe because of the poor _____.
5. Several fire extinguishers are _____ in the cabin for precaution.
6. With the rising of _____, the temperature is falling rapidly.
7. We placed everything at his _____.